Summary
Steller Sea Lion Recovery Team Meeting
Alaska Fisheries Science Center, Seattle, Washington
11-13 February 2003

Bob Small, Chair of the Steller Sea Lion Recovery Team (SSLRT or RT), opened the meeting at 08:35 on February 11. Minutes from the previous meeting and the draft agenda for the current meeting were reviewed and approved.

Update on Recent Events

DeMaster responded to SSLRT inquiries regarding DPS structure. He noted that the genetic analyses recently reported by Bickham suggest that a phylogeographic break in the Western SSL stock occurs near the borders of the United States and the Russian Republic. However, the methods used by Bickham (which include data from two separate strands of DNA) need to be reviewed. Bickham must also evaluate a recent simulation analysis performed by the International Whaling Commission (IWC) that suggested nested clade analyses are not robust. NMFS is unwilling to formalize a division in the Western stock if there is uncertainty, and supports holding a workshop to evaluate this aspect of SSL stock status. DeMaster and the SSLRT discussed the administrative procedures that could be used if a separation is deemed appropriate. NMFS could implement a change in the listing structure by Emergency Rule, and might take two or three months to prepare and publish the proposed rule. Final rule implementation could occur in three to four months unless there is substantial public comment.

DeMaster reviewed the status of recent litigation involving NMFS and relating to SSL. Judge Zilly recently ruled the agency's 2001 Bering Sea Groundfish Biological Opinion (BiOp) invalid due to inadequacies in its use of telemetry data to rationalize inshore/offshore zonal management and in its description of how fishing affects prey fields within the 10-20 nautical mile (nm) rookery/haulout zones. The latter flaw was termed "fatal". The judged ruled in favor of NMFS on seven other issues, and ruled the BiOp for the Bering Sea Groundfish FMP acceptable. The plaintiffs declined injunctive relief and NMFS has until June 30 to respond to the judge's remand. NMFS has chosen to respond by addressing the two cited flaws using new information. The agency will reexamine telemetry locations associated with animals that are diving deep enough to be foraging. Where data are available on finer temporal and spatial scales, NMFS will also examine where forage fish are located in the 10-20 nm zones. NMFS will work with the North Pacific Fishery Management Council (NPFMC) in drafting the needed addendums. The agency expects to present these materials to the NPFMC and the public for review at the Council's April meeting and to Judge Zilly in mid-May. Fishery management measures described in the 2001 BiOp will go forward in the interim; no major management changes are expected. NMFS will initiate informal consultations later in the year, and a new BiOp will be needed only if there is a likelihood of adverse impact.

The House/Senate Conference Committee continues to consider the agency's FY2003 budget using the Senate mark. An omnibus spending bill is expected later in the week. NMFS funding for SSL research and support using the Senate mark would decline by 77% from FY2002, and funding to endowed agencies would decrease 7%. During the 2001-2003 period, overall funding for SSL research has/will decline from approximately $42 million to $19 million. In an effort to complete the third year of some core studies, NMFS expects to limit reductions in those projects while dropping its shark studies altogether. DeMaster suggested that it will be difficult for the Conference Committee to change this proposed budget because all such changes must be balanced. Although it is likely that a supplemental spending bill will be introduced during March, supplemental funding for SSL research is unlikely to do well in the current environment. NMFS expects to drop much of its bottom-up research under this budget to focus on core studies, and will encourage the endowed groups to take a larger role in climate change and forage fish studies. The agency expects that ongoing research contracted using funds from prior fiscal years will be allowed to continue. NMFS has been attempting to streamline its regional grants program, and DeMaster hopes that grant awards will be out by April or May if the budget is approved in mid-February.

Small briefly described the Anchorage Science Symposium, and reported that many were pleased with the information provided. Fritz made copies of presentation abstracts available on CD for internal use by members of the SSLRT. Some RT members were concerned about the potential for misuse of detailed preliminary information contained in these presentations. Presenters were not informed in advance that these materials would be released, and might have been more cautious had they been aware of this possibility. RT members were cautioned that this distribution should not be cited as an official data source, and that the original authors should be contacted before any of this material appears in agency or SSLRT documents. DeMaster noted that most editors will not publish manuscripts containing data that are freely available on the Internet; organizations like the IWC will not place gray literature on the Internet to avoid jeopardizing later formal publication.

<u>Decline of SSL in Alaskan Waters – Untangling Food Webs and Fishing Nets</u>
Don Siniff, University of Minnesota

Siniff presented a consensus report from the National Academy of Sciences (NAS) review of the interactions between Alaskan groundfish fisheries and SSL. The review was originally requested by Congress, and a diverse group of panelists met between April 2001 and March 2003 to examine the available information on status, interactions, and data gaps. Public meetings were held in Seattle (2), Anchorage, and Florida, and the public testimony taken at these meetings was included in the report's body of information. The panel attempted several new modeling analyses to estimate groundfish biomass and unexplained SSL mortality.

The panel noted that SSL populations declined range-wide during 1976-1984, and that the abundance of other species in the North Pacific (birds, cetaceans, etc.) were also changing rapidly during the 1970s and 1980s. One focus of committee discussion (refer to p. 105 of the report) was whether the population was experiencing bottom-up or top-down control. Bottom-up hypotheses include large scale fish removals, climate shift, and non-lethal disease. Top-down hypotheses include predation, incidental take, subsistence harvest, other shootings, pollution, and lethal disease. Siniff noted that population control need not involve a simple dichotomy of bottom-up and top-down mechanisms and that both can be active at the same time. Existing population models cannot account for the peak annual mortalities (20,000-25,000 animals) of the mid 1980s; those losses are too large to have involved only pups and yearlings and are not explained by fishing or other known sources of mortality. Ecosystem models attempt to describe trophic interactions, but there are large discrepancies between model results and what actually happened. No combination of parameters involving trophics and fishing has been found to match the decline of SSL.

In evaluating bottom-up hypotheses, the committee found that fish removal hypotheses were generally not supported. Adequate foraging biomass appears to have been available, although conflicting studies make localized depletion theories an open question. More research is needed on the reactions of fish schools to fishing, seasonal fish movements, and sea lion foraging behavior. The committee chose to take a wait-and-see approach to climate regime shift hypotheses, since little could be done to affect those processes. Evaluation of top-down hypotheses was similarly inconclusive. Recent rates of entanglement have been low, and although thousands of SSL were taken incidentally by fishing during the mid-1980s these do not account for the observed population declines. Similarly, subsistence harvests do not account for the population declines, and the declines do not coincide with the major period of shootings and predator control harvests that occurred during the 1960s-1972. SSL exhibit some antibodies against a variety of diseases and toxins, but there has been no evidence of widespread disease epizootics. Predation by sharks and killer whales has been discussed, but it is unlikely that these caused the major declines of the 1980s.

The committee concluded that the rapid declines of the 1970s and 1980s were broad and likely caused by ecosystem change in conjunction with other factors. There is some evidence for nutritional limitation. From the 1990s to the present, bottom-up control mechanisms do not appear to be operating. Groundfish biomass appears high, but localized depletion may be a factor in some instances. A combination of top-down factors is probably playing a role in the current suppression of the population.

Information gaps and research needs cited by the committee included gaps in population trends, vital rates, critical habitat, environmental monitoring, and predator feeding habits and population size. The committee recommended increased study of SSLs during the winter. They considered the fate of juveniles pivotal, and recommended research using remote monitoring if necessary. The committee considered a variety of approaches to evaluate the efficacy of fishery management, but their preferred option involved an adaptive management experiment that would establish management control units and evaluate SSL response in experimental (fished) and control (unfished) areas over a timescale of five to ten years. They recommended that these units be selected to minimize the displacement of fisheries to more distant and less safe areas. The size and number of treatment areas depend on the movements of fish and SSL, but replicates need to address issues of environmental variability.

- Some RT members acknowledged a potential role for environmental factors, but questioned why the expanding marine mammal populations of the West Coast (e.g., California sea lions, elephant seals, harbor seals) were not responding similarly to SSLs and why the committee did not address these differences. Siniff acknowledged that the committee considered only conditions in the Aleutians and not those on the West Coast, but noted that the West Coast represents a very different ecosystem. While he could not suggest the mechanisms operating there, he suggested they might include factors such as differences in foraging behavior (e.g., SSLs are relatively coastal while elephant seals are more pelagic).

- RT members questioned whether the NAS review represented the definitive work on threats to SSL, and whether the SSLRT was in danger of duplicating the NAS committee's efforts. Siniff noted that the top-down theme was dominant in the NAS report, and that the data to support it are not very good, the assumptions are major, and additional information is needed. In other systems predators have been shown to be more effective at low population levels, and these conditions should be evaluated for SSL predators. More information is needed about SSL and their predators in winter. The NAS committee believes that the factors affecting SSL now are different than during the 1980s (i.e., bottom-up forces are less active), and that these are all important areas to pursue. Siniff also noted that the SSLRT has more expertise specific to SSL than the NAS committee and recommended that the SSLRT critically evaluate the NAS report. The NAS report was written by several authors and may make some suggestions that are not realistic given SSL life history. When asked why the NAS committee characterized fishing (i.e., removal of fish) as a bottom-up rather than a top-down process (e.g., like the introduction of a new predator), Siniff replied that fish populations sustain SSL from the bottom up so factors that affect fish were included as bottom-up processes.
- The RT asked what purpose an adaptive management experiment would serve if the NAS committee did not believe that SSL are currently limited by food. Siniff replied that the experiment could evaluate whether current restrictions are effective. He noted that the committee did not consider whether a comparison of areas that are currently fished heavily with those fished less intensively could represent a "natural" experiment.
- RT members discussed the significance of abundance patterns in SSL since the 1980s. Some found it significant that the declines of the 1980s were range-wide, yet most of the known threats tend to be clumped geographically. The only known factor to produce similar patterns in other species tends to be disease, but evidence of sick and dying animals has never been observed by researchers or reported by subsistence hunters or other local residents. Others questioned whether there was sufficient effort to find carcasses during the winter, and noted that carcasses may not come ashore; e.g., it has proven difficult to detect sea otter carcasses in an area as populated as California. Others questioned whether the entire period of the 1990s should have been characterized as a single period, suggesting that conditions may have changed again in 1998; Siniff acknowledged that the committee had not tried to partition the 1990s.
- When asked for what the NAS report will be remembered, Siniff suggested its characterization of the 1980s decline as a multi-factored phenomenon driven by factors that are different than those that currently exist. He found the NAS modeling an interesting exercise that illustrated what could and could not be said about the decline. When asked whether the NAS models could be used for future-casting, Siniff replied affirmatively presuming that the current demographic data are available.

Recovery Plan Revision

Small noted that there had been few changes to the text of the Plan since the November meeting. The most significant developments were the draft threat table produced by Loughlin and Pitcher. Since there have been few recent comments on Sections III, V.A&B.1-9, and VI.A&B.1-9, Small suggested these sections be finalized by small groups over the next few months. RT members were concerned that recent literature be included in these sections, and that the writing styles be made consistent. Small cautioned RT members that these sections are to contain only background and description of threats, and that all evaluation and discussion of data gaps should be left to later sections. RT members agreed that including data on the Russian segment of the Western DPS would not be a problem in the background section, but could pose a greater problem at the strategy and recovery action levels since the RP applies only to US territory. The original background group consisting of Calkins, Loughlin, Pitcher, and Trites was asked to meet either in person or via email to complete a "near-final" draft of these sections for distribution and final review by the full RT. Other RT members were asked to send final comments to Loughlin by March 10. Of particular interest are new literature citations (published, in press, and in prep.) and general comments (e.g., are additional sections covering topics such as weaning needed).

Capron has been unable to complete the anticipated revision of Section IV. Parker, Fritz, and Gelatt were asked to work with Capron to complete this revision. RT comments will not be needed until after this revised draft has been completed. Small will discuss a schedule for that work with Capron and Payne.

Small suggested that deadlines for work by the Recovery Criteria group will depend on the progress of the modeling exercises. He suggested that group should work closely with the modelers, and recommended that the composition of members be weighted with those willing and able to provide the technical input that will be needed. Hanson and Parker suggested that their interests were more toward the policy and timeline aspects of Recovery Criteria, and their future involvement will focus on those aspects rather than the quantitative PVA modeling. Pitcher and Gelatt were volunteered as additional members primarily to parameterize the PVA models. To keep the RT informed of assumptions being made in model construction and development, Small will distribute summaries of the working group's teleconferences to the RT and will keep the RT informed as progress is made.

Byrd was asked to take the leading role in further development of the stepdown outline and associated narrative sections. He will work with the authors originally assigned to draft portions of this section (assignments made at the August 2002 SSLRT meeting) to determine whether they will be able to complete these assignments or if other revisions are necessary. RT members reminded each other that the tasks described in the stepdown outline must flow from the threats.

Revision of Threats Table

The RT reviewed a draft Threats Table prepared by Loughlin and Pitcher. Initial discussion focused on understanding the column headings used to categorize each threat. Members were told that there are no legal requirements for these category headings, and that many in the draft table were based on examples from other RPs. The RT discussed whether the proposed headings were relevant and/or informative and whether they should be retained. Other discussion regarding the Threats Table included the following:

- Members discussed whether threats that have already been addressed must still be listed in the current Threats Table and generally agreed to do so. While shooting SSL is already against the law, the RT might wish to recommend actions to ensure that activity remains infrequent or is further reduced. Maintenance of existing rookery/haulout closures might also be an ongoing recovery strategy.
- Some RT members questioned the source for estimates of mortality and were told that many came from background text or tables (e.g., subsistence harvests) while others were simply estimates. Some suggested that footnotes should be used to identify the source of each mortality estimate. Others suggested that the "Knowledge" column could be used to characterize the certainty behind those estimates.
- RT members discussed how to relate the severity category to activities that may affect a large number of animals but for which there is no obvious or demonstrable mortality (i.e., whether a large number of small impacts is important). One suggested estimating the number of animals affected as well as the number of mortalities. Another suggested that no matter how direct and indirect impacts are quantified they will not be comparable.
- Given the uncertainty associated with many mortality estimates, RT members discussed whether there should be a measure of direct mortality from each threat or just a ranking (Low/Medium/High). One suggestion based the ranking near the current value of 208 for PBR (Low<200; Medium 200-500; High>500). Others saw value in attempting to list an approximate estimate of the magnitude of mortality attributable to each threat.
- Some RT members suggested that Nutritional Stress is not a threat but rather the potential impact of a threat. They suggested that the real threat is actually a reduction in prey abundance or quality.
- RT members agreed that the method of scoring each threat will be critical. Some questioned how that process could be accomplished when many of the parameters are subjective and qualitative. Most seemed to agree that the score should be related to both the size of the impact and its likelihood of occurrence. A sorting of the scores could then be used to rank the relative severity of threats. Scoring should be done in a manner that makes it easy to identify action items.

Using a revised Threats Table, the RT attempted several examples (direct disturbance from research, mortality from incidental killing, loss from biotoxins). There was little agreement on utility of columns or on the significance of their scoring. Further discussion of the table was deferred to a small group that met on February 13.

The smaller group (Atkinson, Byrd, Hanson, Jack, Williams, Wynne) suggested a revised set of Threats tables (Appendix A), with definitions for each of the column heading categories. The suggested score for each threat would be derived from the product of the "Probability of Occurrence" ranking (3 levels) and the "Total Loss" ranking (5 levels). The group suggested that these scores could be evaluated using a modified Boston Squares matrix that charted increasing Probability of Occurrence rankings against increasing Total Loss rankings. Highest priority threats to SSL recovery should cluster in the corner of the matrix corresponding to high Probability of Occurrence and high Total Loss. Blank copies of these tables were distributed to RT members before the meeting adjourned. Members were asked to complete the table and return it to Small as soon as possible so that the degree of consensus among members of the RT on threats can be assessed.

<u>Evaluation of the Effects of Fishing on Steller Sea Lions</u>

Fritz and Eggers presented a draft evaluation of fishing impacts on SSL. They suggested that fishing for groundfish and other prey could reduce the ecosystem's SSL carrying capacity by (1) reducing ecosystem-wide or local prey abundance or availability, (2) disturbing sea lions, or (3) changing the composition of the fish community, resulting in prey of lower quality, increases in predation on sea lions, or increases in competition with other species for prey. They focused on the first of these hypotheses because there is no measure of competitive disturbance, and there is no way to distinguish between fishery-induced changes in fish community structure and those resulting from climate change.

Although all examples are not necessarily related to the decline of SSL, Hypothesis #1 is supported by evidence for the capability of fisheries to overfish, particularly when relatively unconstrained (e.g., yellowfin sole and herring in the EBS in the 1960; Pacific ocean perch in the GOA and Aleutian Islands, pollock in the EBS in the early 1970s, crabs in the EBS and GOA, shrimp in the GOA). Support for decreases in prey abundance on small scales may be found in Atka mackerel fishery CPUEs, Pacific cod fishery CPUEs, pollock harvest rates by area in the EBS, and the disappearance of some pollock spawning aggregations in the Aleutians and GOA. It is difficult, however, to distinguish small scale fishery-induced reductions from seasonal movements.

Evidence for decreases in prey biomasses on a large scale is complicated when attempting to distinguish fishery-induced reductions from natural change. Some species may be consistent with the hypothesis that fisheries have caused large-scale reductions in prey biomasses (e.g., GOA Pollock, and perhaps GOA mackerel), while others may not (e.g., EBS pollock, and perhaps BSAI and GOA Pacific cod). Fritz and Eggers presented a tabular comparison of the trends in abundance of several SSL prey species (including salmon and herring) and several non-prey species over time in SSL stock regions. Overall trends in prey abundance were consistent (i.e., either increasing or decreasing concurrently) with trends in SSL abundance in 29 or 30 cases, inconsistent in 45 or 44 cases, and unknown in another 28 cases. For species identified as primary prey in BiOp 3, 1or 2 cases were consistent, 16 or 15 cases were inconsistent, and 6 cases were unknown. For species identified as secondary prey in BiOp 3, 17 cases were consistent, 14 cases were inconsistent, and 11 cases were unknown. For non-prey, 11 were consistent, 4 were inconsistent, and 5 were unknown. Eggers suggested that broad ecosystem changes are complex and difficult to relate to SSL. He suggested that there is little evidence that there is a link between trends in abundance of primary prey species and SSL, although there may be a somewhat stronger link for forage fishes.

Other issues to consider include (1) the effects on prey availability of the practice of fishing when availability is greatest (e.g., cod, Pollock, herring, salmon at spawning times) which is similar to the way in which SSL use these prey, (2) the cumulative effects on prey availability of fishing many species at once, and (3) the effects of changes in the age structure of fished populations on availability of prey to sea lions (e.g., fewer older fish remain, smaller average size, younger average age, lower spawning biomass).

RT questions and discussion:

- Some RT members expressed particular interest in what happened to prey populations in the early 1980s so that they might relate them to the increase in SSL mortalities during the same period. Others suggested the data had most utility in increasing the RT's understanding of carrying capacity. The RT will need to know the prey base that is necessary to support target SSL recovery levels. They may be able to gain some understanding by assessing the prey picture when SSL were abundant and contrasting that with current conditions. Fishery data provide some insight into what resources were present in the past.

- Some RT members found the tabular presentation of population trends difficult to evaluate and requested a more graphical approach to illustrate when particular events took place. Others requested more detail, noting there is a strong spatial/temporal component to fisheries. They suggested that the serial depletions and declines of crab and shrimp may be indicators of ecosystem change that cannot be evaluated without the spatial component. They noted that NMFS has analyzed historical patterns relative to SSL and has also examined current conditions. They suggested that NMFS should provide all available data on catches in critical habitat since 1977.

- RT members suggested a number of ways in which the evaluation could be enhanced. These included the addition of a current temporal period to reflect current conditions; fish species-specific and area-specific information on a finer scale; information on the levels of fishing effort; explanations of the assumptions made, areas, symbols, etc.; a figure with trend lines and possibly overlapping regime shifts. A small group (Calkins, Frazer, Fritz, Springer) was asked to continue developing the evaluation of fishery impacts and to consider how available evidence of reduced prey might translate into nutritional stress.

<u>Distribution and Ecotype of Killer Whales in Southwestern Alaska</u>
Paul Wade, National Marine Fisheries Service

Wade described results from the first two years of the three-year Distribution and Abundance of Residents and Transients (DART) killer whale survey project estimating the abundance of transient killer whales potentially foraging on the Western stock of SSL, and described the distribution and movements of transient killer whales in the study area. Researchers estimate killer whale abundance and identify ecotypes using photo identification categories, mark recaptures using photo identification, and line transect surveys. Survey vessels worked randomized transects within designated blocks in passing mode, switching to closing mode when killer whales were encountered. Researchers photographed animals they encountered, and when conditions were suitable they collected biopsy samples (for genetic, contaminant, and stable isotope studies) and acoustic recordings. The survey area along the coast aligned with SSL abundance blocks in the Western stock area; offshore the survey area encompassed the 20 nm foraging zones around major SSL rookeries and haulouts. DART survey personnel also participated in cruises for the Aleutian Passes Project in 2001-02, the 2002 Bering Sea Pollock trawl survey, and the 2002 Eastern Bering Sea Right Whale survey. Wade related several incidents where researchers observed transient killer whales foraging on minke and gray whales or harassing humpback whales, and a day in which 45 transients were observed in Unimak Pass.

The program will need at least three years to obtain an adequate sample size for its estimate of the abundance of killer whales in the area, and to account for group size as a covariate of detection probability. Residents tend to travel in groups averaging about 15 animals, while transient groups are generally smaller (approximately 4 animals). Encounters in the Aleutian Passes and other cruises will be the "mark" in the mark recapture experiment, while encounters during the randomized DART surveys will be the "recapture". The 2001 Aleutians Passes survey encountered 102 unique individuals, all of which were residents. The 2001 DART surveys encountered 211 unique individuals, 155 of which were residents, 24 transients, and 32 offshore type.

A preliminary summary of ecotypes suggests that 65-86% of the killer whales in the study are the resident type, approximately 7% are transient, 3-4% are offshore, and the type of the remainder is unknown. The 2001-2002 DART surveys detected only transient animals in the area from Kodiak to Unimak Pass, only resident animals around Kodiak and Dutch Harbor, and concentrations of both types in the vicinity of the Aleutian passes. Other potential prey for transient killer whales in the area include Dall's porpoise, minke whales, humpback whales, fin whales, and gray whales.

RT questions and discussion:

- RT members asked whether there were any identifiable population trends for other cetaceans in the area, and whether there is any evidence of killer whales switching from cetacean to SSL prey. Wade noted that some researchers believe that populations of Dall's porpoise have also declined but there is little supporting evidence. Even if true, the decline would be relative because Dall's porpoise remain numerous. Researchers are attempting to assemble the available information on prey-switching, but the data will be semi-quantitative at best.
- When asked whether the survey area would be expanded to the west during 2003, Wade replied that concerns over adequacy of the mark recapture experiment sample size will likely dictate a replicate survey over the same study area. Offshore killer whales have been resighted from the Aleutians to southern California, so researchers must weigh the benefits of a good estimate for the central region against a poor estimate throughout the range. Funding for the third study year remains in doubt. DART researchers do not have the ability to survey all areas every year, so they are attempting to obtain some data from Russian waters through collaborating scientists.
- RT members suggested that some researchers conducting photo identification studies are skeptical of line transect estimates of abundance, but Wade noted that the technique is used for other cetaceans and that scientific journals do not seem to share that skepticism. Barrett-Lennard suggested that the concerns might relate more to the behavior of transient killer whales than with the technique itself; transient sightings are infrequent so the CVs associated with estimates are high. Wade suggested that it may prove feasible to expand sighting data in combination with the detection functions for other species.

- The names “transient” and “resident” apparently have no particular significance, and could easily be renamed Type A and Type B. The labels were appropriate for initial studies during the summer in Johnstone Strait, but are less applicable in other portions of the range.
- Wade was unwilling to estimate bounds for the transient killer whale population. The current minimum estimate is about 50-70 animals, and researchers will consider both line transects and mark recapture to corroborate the estimate. The mark recapture estimate will undoubtedly be an increase over the minimum estimate.
- Satellite tagging remains problematic for killer whales, and NMFS researchers are in contact with colleagues who are tagging other species. One VHF tag was deployed several years ago but the tag failed immediately. Killer whales are difficult to tag because the subject animal must be captured; there are no reliable projectile satellite tags currently available. Researchers are pursuing short-term suction cup tags that may make tracking possible for a couple of days.

Southeast Alaska Transient Killer Whale Predation Behavior
Presented by Paul Wade for Marilyn Dahlheim, National Marine Fisheries Service

Dahlheim’s observations were conducted during daylight hours in the summer. Locating predators proved to be difficult, requiring the services of a dedicated research vessel. Some long term data are available since 1984, and routine surveys have been conducted since 1991. Unlike the DART studies, these surveys do not follow transects but do follow a consistent route throughout Southeast Alaska. Like the DART surveys, researchers use inflatable boats to approach whales. Researchers record the location and duration of the encounter, and follow the whales until conditions prohibit further tracking. Behavior is categorized as: Traveling, Pass, Pursuit, or Kill. Captures were generally evidenced by pursuit, milling, disappearance of the prey, and often by evidence of injury to the prey (blood plume, oil, remains in the water, etc.). The observed hourly kill rate was expanded to a 24-hour period per whale.

Over 25,000 miles have been surveyed, and 130 individual transient animals have been identified. Researchers have spent a total of 266.5 hours observing killer whale behavior. There have been 84 group sightings during 1991-2001, and the ratio of transient to resident sightings is 0.7-1.0. Thirty-nine percent of these sightings involved a kill event. Prey taken by killer whales include Dall’s porpoise (12), Steller sea lion (4), harbor seal (2), harbor porpoise (1), white side dolphin (1), sea birds (2), fish (4), and unidentified marine mammals (7). Researchers have not observed any targeted attacks of humpback whales. Of the individual killer whales observed, four have been matched to transient sightings in Prince William Sound, 6-8 have been matched to sightings in Oregon, and 4 have been matched to sightings in California. The observed kill rate is 0.83 items/whale/day (about 245 lb/whale/day), which approximates the estimated consumption rate of 5% of body weight per day. This rate represents a daily equivalent of 0.5 SSL, 2.5 harbor seals or porpoise, or 0.75 Dall’s porpoise.

RT questions and discussion:

- A combination of genetics and visual characteristics were used to identify transient animals in this study. Since individual animals were resighted frequently, biopsy samples were not collected at every encounter.

- RT members cautioned that the energetic conversions of blubber and meat are not the same, so calculating equivalent values between species may not be a simple weight conversion.
- There was no expansion of the daily SSL equivalent to an estimate of annual consumption of SSL. The estimated equivalents apply only to the portion of time these killer whales spend in Southeast Alaska.

Impact of Predation of Steller Sea Lions by Killer Whales in Western Alaska
Lance Barrett-Lennard, University of British Columbia

In British Columbia and Southeast Alaska, resident killer whale ecotypes are characterized by typical group sizes of 5-40 animals, acoustically conspicuous calls and sonar, and feeding focused exclusively on fish. Transient animals are found in groups of 2-10 animals, are acoustically cryptic, and feed exclusively on marine mammals. Acoustic patterns are a principal distinguishing characteristic in the field. The Alaska resident population is an estimated 500+ animals, northern British Columbia residents are approximately 200 animals, and southern residents are about 85 animals. The West Coast population of transient killer whales is an estimated 219 animals, the Gulf of Alaska transient population is an estimated 40+ animals, and the Prince William Sound AT1 transient group is an estimated 10 animals. Offshore-type killer whales are estimate to number 200+. Offshore killer whales range from California to the northern Gulf of Alaska, are physically small and frequently scarred, and males show little elongation of the dorsal fin. The diet of offshore animals includes fish and squid, and predation on marine mammals appears to be rare. Residents and offshore types have no known impact on SSL, but transients have a direct impact from predation and possibly an indirect impact from predator avoidance.

Mitochondrial DNA (d-loop) analysis of killer whales divides residents and transients into two well-separated clades. Offshore animals appear to cluster with residents, while AT1 transients have their own genetic type that is more diverged from other transients.

Genetic differences readily distinguish residents and transients, but have been unable to separate fish/mammal prey habits in other parts of the world. In studies of killer whales in Southeast Alaska, the northern Gulf of Alaska, and the eastern Aleutians, only two predations on marine mammals were observed in 69 encounters. Biopsy samples were collected in both cases and the killer whales exhibited mtDNA identical to the Gulf of Alaska transient population. Three other groups exhibiting behaviors typical of mammal hunters also had transient mtDNA haplotypes. Twenty-three biopsies from killer whales exhibiting fish-eating behaviors had resident haplotypes. There were no observed physical associations between putative fish hunters and mammal hunters. No matches were made between the 483 killer whales identified in the eastern Aleutians and the 550 identified in Prince William Sound, Kenai Fjords, and Kodiak.

RT questions and discussion:

- The exclusive meat/fish diets of transients and residents do not appear to overlap. Fish-eating killer whales probably eat sablefish, salmon, and a variety of other species. Researchers have collected scale samples from killer whale prey items and have found chinook salmon to be common in British Columbia while coho salmon are common in

Prince William Sound. Blubber samples are not extensive enough to allow fatty acid analysis of a killer whale's diet; blubber is stratified and current dart samplers penetrate only the first few centimeters of blubber at the surface.

Decline of SSL in Western Alaska – A Simulation Study
Lance Barrett-Lennard, University of British Columbia

Barrett-Lennard described a study examining conditions during the early phases of the decline of SSL to evaluate whether killer whales could have played a role in that decline. Although killer whale predation on SSL was once thought to be rare, stomach samples indicate that SSL are taken by killer whales. Data from Gulf of Alaska transients suggest that mature SSL are harassed by killer whales more often than they are killed, but pups may be taken more often.

The study began with an age-structured life table for SSL, an estimated consumption rate of 73 kg/day, a process error (CV=0.2) in consumption to simulate wastage, and assumed a stable age distribution and some predation mortality implicit in the life tables. The model also allows adjustments to the vulnerability of various SSL age classes, and variable proportions of SSL in the diet over time. Modelers created scenarios to describe what would happen if predation increased starting in 1974 by varying both the numbers of new transient killer whales and the proportion of SSL in their diet.

Depending on the parameters chosen, the model suggests that it is indeed possible for killer whales to have played a role in the decline of SSL. The model was found to mimic observed SSL population trends by adding a population of 125 killer whales whose diet was 60% SSL. If their diet was 100% SSL, only 70 new transients were required. If 250 new transients were added, the SSL proportion of their diet need only be 27%. The impacts of killer whale predation were most severe if calves are most vulnerable. The model projects that SSL could be trapped in a "predator pit" by only 120 killer whales that increase the SSL proportion in their diet by 20%.

RT questions and discussion:

- The model assumes an even distribution and impact of killer whales over the range, and this assumption is unrealistic. Killer whales in British Columbia have preferred foraging areas. The BC coastline is complicated, and there are some areas where large populations of SSL have not attracted predation by killer whales. It is possible that the characteristics of some rookeries make approach and foraging by killer whales more difficult.
- When RT members asked why killer whales were not attracted to large California sea lion rookeries off the West Coast, Barrett-Lennard replied that there are no good data on predation by transient killer whales in California. In British Columbia there are many alternative prey, and transients seem to prefer harbor seals.
- The number of catalogued transient killer whales has increased from about 50 in 1987 to over 200 animals today. Expanded study is undoubtedly responsible for some of this increase, but some may be due to population growth because pod sizes are also larger. The impact of an increased transient killer whale population on pinnipeds depends largely on how many cetaceans they are eating. West Coast transients routinely feed on gray whales.

Predation by Sharks

Small distributed several email summaries of the information available on predation by sharks. Generally, there is no evidence that sleeper or salmon sharks actively prey on SSL. Several ongoing studies may provide additional information. Similarly, there is little information on or observations of predation by white sharks on the Eastern SSL population. RT members noted that the metabolic rate of sharks is much lower than that for killer whales, although there could be mortalities related to shark attacks.

Recovery Criteria Working Group

Small reported that the Recovery Criteria Working Group held two teleconferences since the November meeting, and these have addressed three main issues. (1) How should the RT integrate the use of 'body counts' with PVA models for delisting/downlisting criteria? The IUCN and CITES groups have used a non-modeling approach. The working group would like to continue the PVA approach, but Small suggested that the criteria developed by the group may have a "body count" ring to them. The group will attempt to interpret the PVA models though "body count" parameters as used by the IUCN and CITES groups. (2) Where does the group stand regarding extinction probability and the time frame? Some group members are not ready to fully embrace the "1% in 100 years" standard. The group plans to examine and understand the reasoning behind this standard, and explore the use of different values that may include a shorter time frame. The group plans to report its findings and recommendations to the RT. (3) How should delisting criteria be addressed? According to the IUCN approach, population improvements that would merit a category upgrading must stay in place for five years before the status actually changes.

Both the Winship and Goodman models are sufficiently developed to require input values. York will not pursue her PVA model further, but wishes to stay involved as an advisor in the parameterization of the other models.

PVA Modeling Report
Dan Goodman, Montana State University

Goodman described his efforts as an attempt to construct a bare-bones, minimum complexity model that provides a framework under which the RT can put available information to say whether the SSL population is going up or down.

Since regimes in the Bering Sea are an inescapable fact of life, the model provides "good" and "bad" regime options. Within each regime, the model must have a life table that describes parameters like survival and fecundity rates by rookery. Data from the Western DPS for the last 20 years can be used to characterize a "Bad" phase. While these data are reasonably good for adult survival, juvenile data must often be extrapolated from the life tables and from population growth rates. The characteristics of a "Good" phase life table are uncertain, and Goodman plans to start with a current life table for the Eastern DPS. Estimates of growth rates for this phase will require judgment and will include uncertainty. The model must be given two transition probabilities for regime shifts, one in each direction. Oceanographic information, core samples, tree rings, and similar data will be used to estimate these probabilities and their associated uncertainties. Modelers can allow the SSL population to go into free fall during a “Bad” regime, but must establish a population cap associated with each rookery during a “Good” regime. The model currently represents the dynamics at different rookeries and the migration between them with a single parameter --- the probability of migration to the next nearest stepping stone.

These elements are sufficient to run and score the model in its current configuration. The modeler can specify thresholds for the number of rookeries occupied and the total population size, and the model will output the frequencies of dropping below those two thresholds.

RT questions and discussion:

- The model could be used to test fishery impacts if there is a hypothesis about which enough is known to attach probabilities. Goodman believes that such an exercise is not worth the effort if it represents pure speculation, because any number could be input to drive the desired outcome. He recommended that the model be kept as simple as possible until the RT has evidence that some factor actually plays a role.
- RT members asked whether the “Bad” phase life table represented current conditions or the period during which it was developed, since current conditions may be in transition. Goodman replied that the life table is old but the growth rate is current. Researchers have not yet seen a change in SSL growth rates that would indicate a switch from “Bad” to “Good” regimes, but recent oceanographic conditions seem to have stabilized. To model this condition, Goodman could assign a probability to the starting state for each model run.
- A RT member expressed skepticism that current conditions represent a “Bad” phase since the status of West Coast pinnipeds is robust; regimes may be no more than annual variation. Goodman noted that if regimes are merely interannual variation, then the transitional probability used in the model would be higher. He also observed that regimes do not interact the same way in all places, and that conditions in California and Alaska are out of phase.
- RT members asked whether it is possible for the model to project population decreases in a “Good” regime or population increases in a “Bad” regime. Goodman replied that if the model can only extrapolate declines then the conclusion for SSL is forgone. If the status of current information is so poor that no different numbers could ever be supplied, then the RT has no basis for delisting and recovery. The model’s default assumption is continued decline, and there must be logical reasons why reversals could occur. The RT might use the model to determine how good management must be to switch the model from its default assumption, and then decide if management that good is plausible and reasonable.
- The RT asked how population structure could be modified by evidence of adjacent populations acting together (i.e., a tendency for metapopulations). Goodman responded that such situations can easily be reflected by adjusting rookery interchange variables. It is much harder to assess whether such interactions would carry through “Bad” and “Good” regimes.

SSLRT Meeting Schedule

The next meeting of the SSLRT was tentatively scheduled for two days during the first week in May (5-9) 2003 in Juneau, Alaska. Items tentatively scheduled for the agenda include discussions of the linkages between fishing and nutritional stress, and of the responses from RT members on composition of the Threats tables.

Working Group Meetings

On February 13, the RT separated into the following smaller working groups:

- PVA Group (Eggers, Gelatt, Parker, Pitcher, Small, Trites) – worked with the modelers to further refine modeling parameters.
- Nutritional Stress Group (Calkins, Fraser, Fritz, Springer) – worked to further clarify linkages between fishing and nutritional stress
- Threats Tables Group (Atkinson, Byrd, Hanson, Jack, Small, Williams, Wynne) – worked to define column headings, scoring, and evaluation.

After a revised set of Threats tables was distributed, the meeting adjourned at approximately 11:30 on February 13.

Table 1. Attendance at the meeting of the Steller Sea Lion Recovery Team held February 11-13, 2003 at the Alaska Fisheries Science Center, Seattle, Washington.

*	Shannon Atkinson	Alaska Sea Life Center
	Lance Barrett-Lennard	University of British Columbia; Vancouver Aquarium
~	Linda Behnken	Alaska Longline Fishermen's Association
*	Vernon Byrd	U.S. Fish & Wildlife Service
*	Don Calkins	Alaska Sea Life Center
	Doug DeMaster	National Marine Fisheries Service
†	Al Didier	Pacific States Marine Fisheries Commission
*	Doug Eggers	Alaska Department of Fish and Game
*	Dave Fraser	F/V Muir Milach
*	Lowell Fritz	National Marine Fisheries Service
*	Tom Gelatt	Alaska Department of Fish and Game
	Dan Goodman	Montana State University
*	Dave Hanson	Pacific States Marine Fisheries Commission
*	Lianna Jack	Alaska Sea Otter and Steller Sea Lion Commission
	Mary-Anne Lea	North Pacific Universities Marine Mammal Research Consortium
	Terry Leitzell	Icicle Seafoods
~	Tom Loughlin	National Marine Fisheries Service
	Lloyd Lowry	US Marine Mammal Commission
*	Donna Parker	F/V Arctic Storm
	Mike Payne	National Marine Fisheries Service
*	Ken Pitcher	Alaska Department of Fish and Game
	Don Siniff	University of Minnesota
**	Bob Small	Alaska Department of Fish and Game
*	Alan Springer	University of Alaska, Fairbanks
*	Ken Stump	
*	Andrew Trites	University of British Columbia & North Pacific Universities Marine Mammal Research Consortium
	Paul Wade	
*	Terrie Williams	University of California, Santa Cruz
	Ben Wilson	North Pacific Universities Marine Mammal Research Consortium
	Arliss Winship	North Pacific Universities Marine Mammal Research Consortium
*	Kate Wynne	University of Alaska, Kodiak

* Steller Sea Lion Recovery Team Member
~ Steller Sea Lion Recovery Team Member, absent
** Chair, Steller Sea Lion Recovery Team
† Rapporteur

STELLER SEA LION RECOVERY TEAM
Agenda

11-13 February 2003
Alaska Fisheries Science Center, Traynor Room
Seattle, Washington

Tuesday, 11 February

8:30 am
1. Review and approval of agenda
2. Response to our letter on DPS structure, Judge Zilly decision, FY03 funding, Anchorage Science Symposium, Housekeeping, other?

9:00 am
3. NAS report overview and discussion – Don Siniff

11:00 am
4. Recovery Plan Revision
    - Progress to date
    - Outline/plans for completion

12:00 pm – Lunch Break

1:15 pm
5. Recovery Plan Revision
    - Team restructuring & tasks

2:30 pm
6. Sections B.10 (V & VI): Threat tables

Wednesday, 12 February

8:30 am
7. Draft approach to evaluate nutritional stress – Doug Eggers & Lowell Fritz

9:30 am
8. Assessment of predation risk
    - Sharks – Written summaries from Lee Hulbert & Ken Goldman
    - Killer Whales – Paul Wade & Lance Barrett-Lennard

12:00 pm – Lunch Break

1:15 pm

9. Assessment of predation risk – further discussion

2:00 pm

10. Recovery Criteria
    - Update from sub-group
    - PVA model presentation – Dan Goodman

4:00 pm

11. Determine major topics for next meeting; e.g., nutritional stress assessment, recovery criteria, research reviews, etc.

Thursday, 13 February

8:30 – 12:00 pm

12. Smaller groups meet separately to address:
    - PVA parameterization
    - Completion of Background Sections III, IV, V.A&B, & VI.A&B
    - Drafting of Sections V.C & VI.C: Recovery Strategy
    - Further development of Stepdown Outline and Narrative

Appendix A
Draft threat assessment (current threats only) for the WESTERN population of Steller sea lions

Threat	Source	Geographic Range		Probability of Occurrence	Estimated Direct Loss	Estimated Indirect Loss	Total Loss	Uncertainty	Feasibility of Mitigation	Score
Disturbance	Vessel traffic, tourism									
Disturbance	Research									
Reduced prey availability	Natural environmental conditions									
Reduced prey availability	Fishing, prey removals									
Reduced prey availability	Change in predator mix; cetacean removals									
Low quality prey	Natural and anthropogenic									
Disease	Natural									
Disease	Anthropogenic									
Pollution	Anthropogenic									
Pollution	Natural									
Predation	Killer whales									
Predation	Sharks									
Illegal shooting	Anthropogenic									
Incidental catch	Anthropogenic									

Appendix A
Draft threat assessment (current threats only) for the WESTERN population of Steller sea lions

Threat	Source	Geographic Range		Probability of Occurrence	Estimated Direct Loss	Estimated Indirect Loss	Total Loss	Uncertainty	Feasibility of Mitigation	Score
Subsistence harvest	Anthropogenic									
Research	Anthropogenic									

Threat: Any action or process that can impact the health or survivability of SSL (i.e., what could go wrong)
Source: The cause of the threat
Geographic Range: Rate both the range of occurrence and the range of impact using the following scales (e.g., L/B)
    L = localized (site specific) or confined to one sub-region
    B = broad, more than one sub-region
    DPS = stock-wide
Probability of Occurrence: Probability that a threat will occur (1=low, 2=medium, 3=high)
Estimated Loss:
Direct: A point estimate (or range) of individual SSL that will die annually as a result of the threat
Indirect: A point estimate (or range) of individual SSL that will ultimately die annually due to the impact of the threat but may have died of another etiology
Total Loss: The total annual loss of SSL due to this source (1= 0-50; 2= 51-200; 3= 201-500; 4= 501-1000; 5= >1000)
Uncertainty: The uncertainty associated with knowing the estimated loss (Low, Medium, High --- L,M,H)
Feasibility of Mitigation: Management's ability to reduce the threat (Low, Medium, High --- L,M,H)
Score: Multiply scores for Probability of Occurrence (column 4) by those for Total Loss (column 7)

Appendix A
Draft threat assessment (current threats only) for the EASTERN population of Steller sea lions

Threat	Source	Geographic Range		Probability of Occurrence	Estimated Direct Loss	Estimated Indirect Loss	Total Loss	Uncertainty	Feasibility of Mitigation	Score
Disturbance	Vessel traffic, tourism									
Disturbance	Research									
Reduced prey availability	Natural environmental conditions									
Reduced prey availability	Fishing, prey removals									
Reduced prey availability	Change in predator mix; cetacean removals									
Low quality prey	Natural and anthropogenic									
Disease	Natural									
Disease	Anthropogenic									
Pollution	Anthropogenic									
Pollution	Natural									
Predation	Killer whales									
Predation	Sharks									

Appendix A
Draft threat assessment (current threats only) for the EASTERN population of Steller sea lions

Threat	Source	Geographic Range		Probability of Occurrence	Estimated Direct Loss	Estimated Indirect Loss	Total Loss	Uncertainty	Feasibility of Mitigation	Score
Illegal shooting	Anthropogenic									
Incidental catch	Anthropogenic									
Subsistence harvest	Anthropogenic									
Research	Anthropogenic									

Threat: Any action or process that can impact the health or survivability of SSL (i.e., what could go wrong)
Source: The cause of the threat
Geographic Range: Rate both the range of occurrence and the range of impact using the following scales (e.g., L/B)
  L = localized (site specific) or confined to one sub-region
  B = broad, more than one sub-region
  DPS = stock-wide
Probability of Occurrence: Probability that a threat will occur (1=low, 2=medium, 3=high)
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